



PSM -STLO recent works on filtration separation

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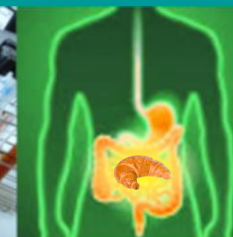
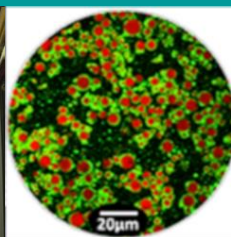
AGRO
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Welcome



STLOpen Days
19–21 March 2019



Maksym Loginov – PSM, STLO



“PSM-STLO recent works on filtration-separation”

- method we use
- things we do
- originality of our approach

In 2016–2019

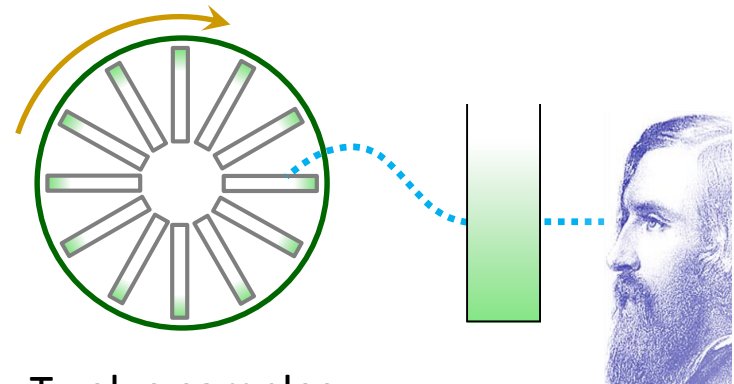
- analytical centrifugal consolidation
- analytical centrifugal ultrafiltration
- cross-flow filtration
- filtration-consolidation theory



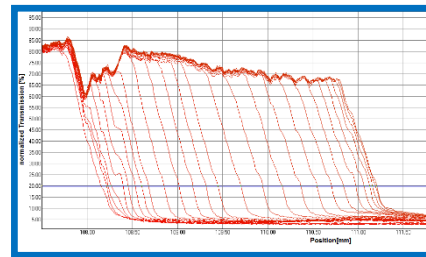
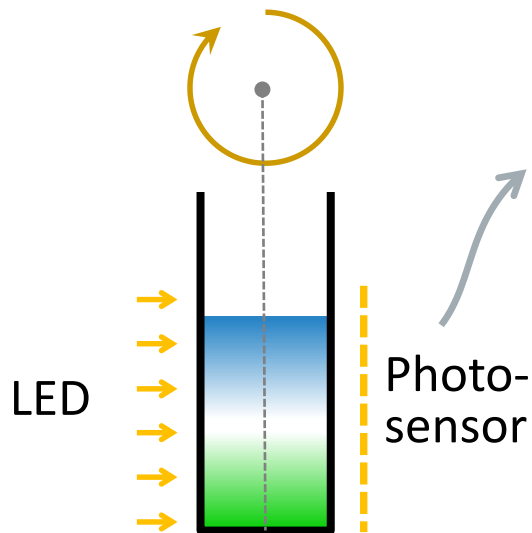
Analytical centrifugation



Analytical centrifuge Lumisizer (LUM)



Twelve samples
of about 1 ml



Measured light transmission profiles

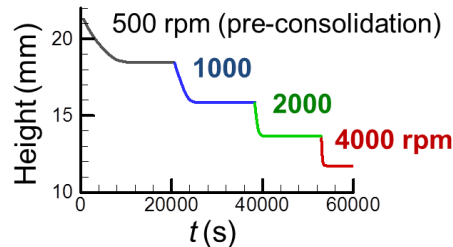
Diluted samples = particles settling/floating rate,
concentrated samples = sediment/cream height
vs centrifugation time and acceleration

Method of centrifugal consolidation

Compressibility and filterability from kinetics of centrifugal consolidation
(for concentrated suspensions)

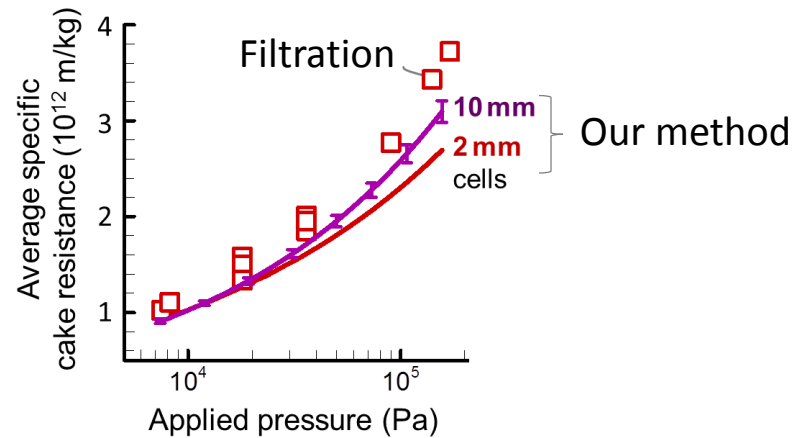
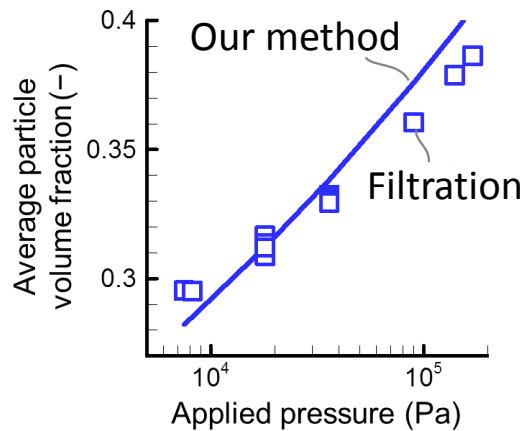
MODEL
$$\frac{\partial p_s}{\partial t} = - \frac{\partial p_s}{\partial (1/\phi)} \cdot \frac{\partial}{\partial \omega} \left(\frac{1}{\mu \rho_s \alpha(p_s)} \cdot \left[\frac{\partial p_s}{\partial \omega} + \Delta \rho a_i \right] \right)$$
 Basic filtration-consolidation equation

EXPERIMENT

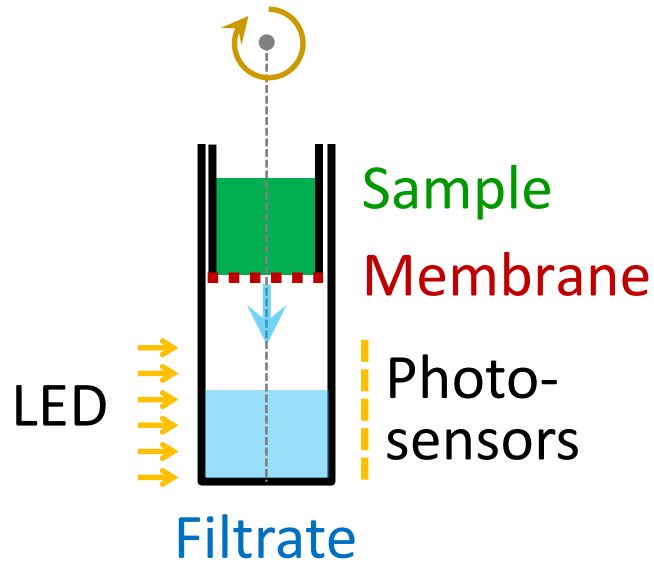


Special protocol of centrifugal speed ramping

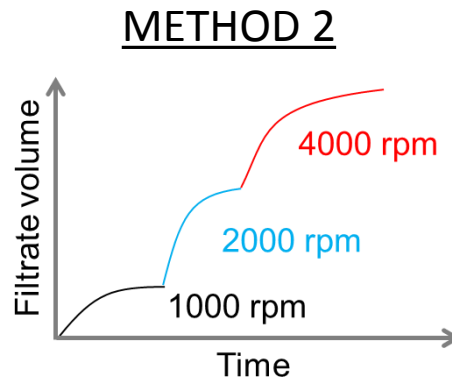
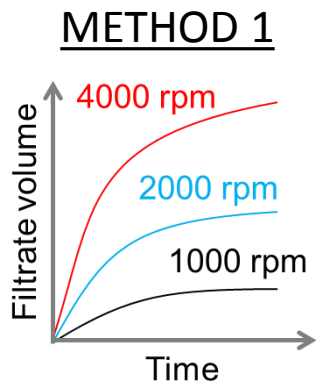
RESULT



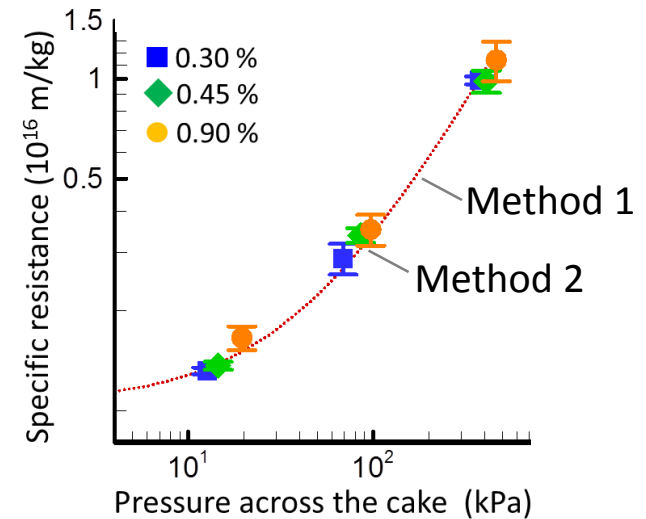
Methods of centrifugal ultrafiltration



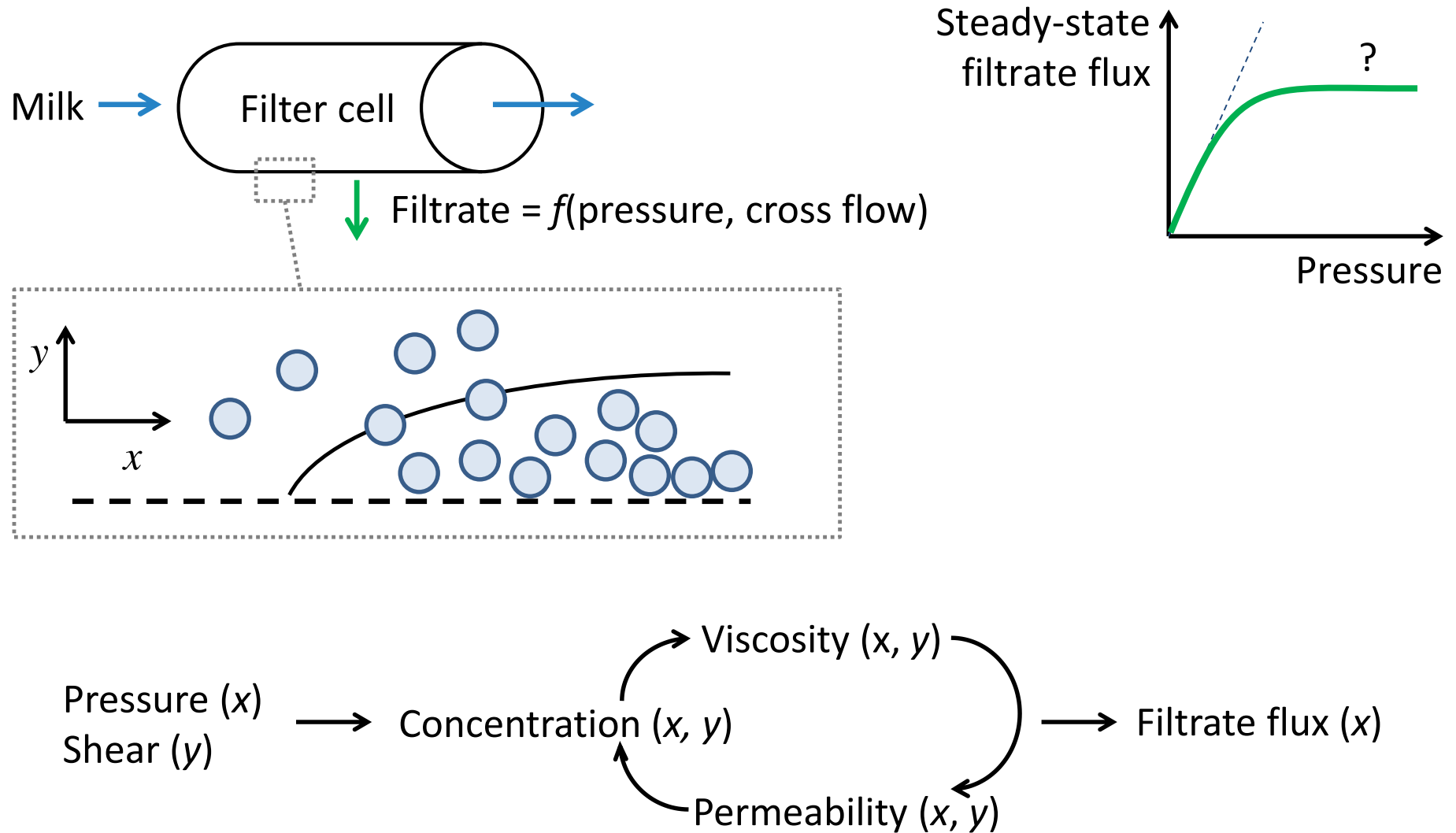
Cells of about 1 ml
Exchangeable membrane



RESULT (on example of BSA)



Modeling of cross-flow filtration



Our model of cross-flow filtration (laminar)

Concentration = $f(\text{pressure})$

Permeability = $f(\text{concentration, shear})$

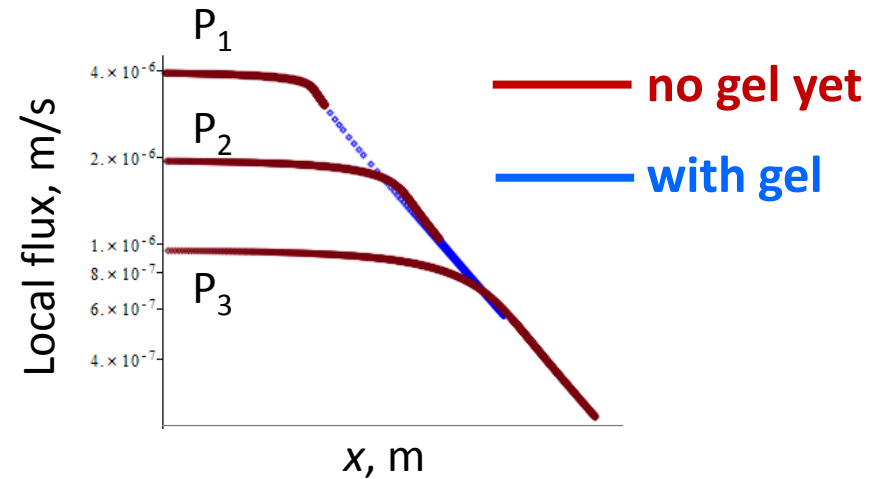
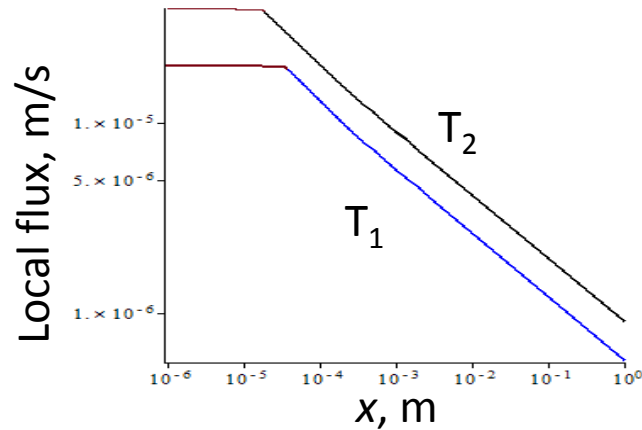
Viscosity = $f(\text{concentration, shear})$



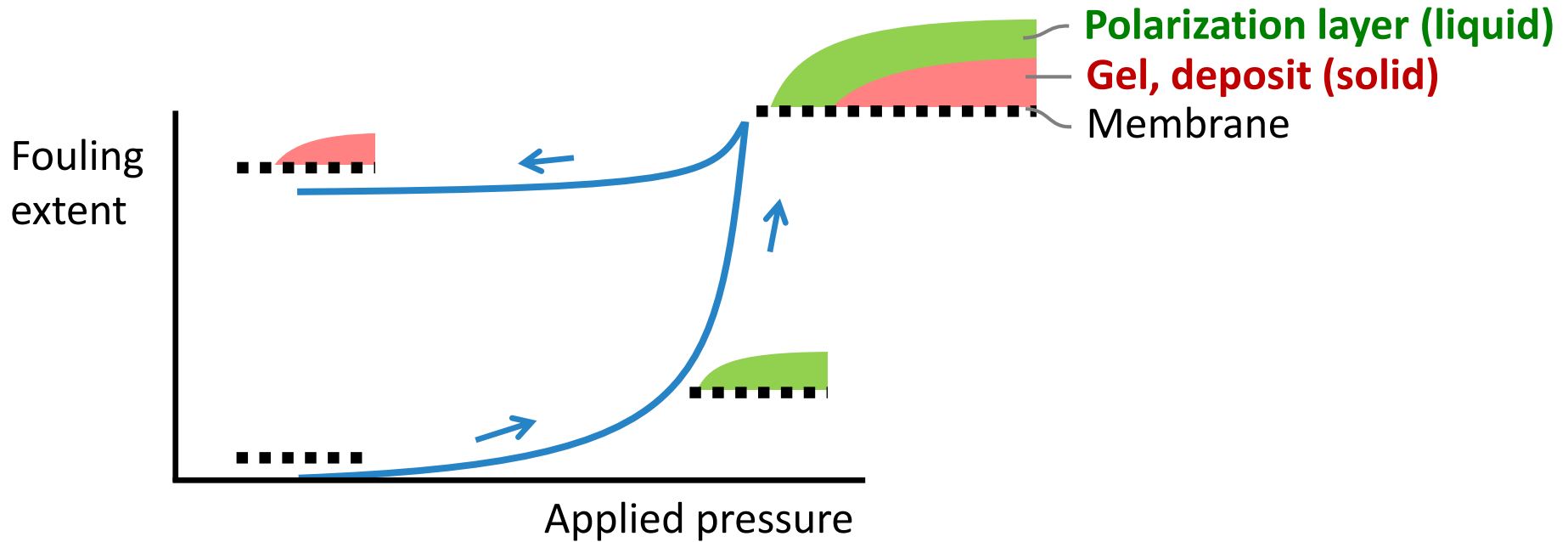
Eq. 1 here

Eq. 2 here

Eq. 3 here



Irreversible membrane fouling



Fouling is not removed in the test,
irreversible fouling,
critical fouling conditions

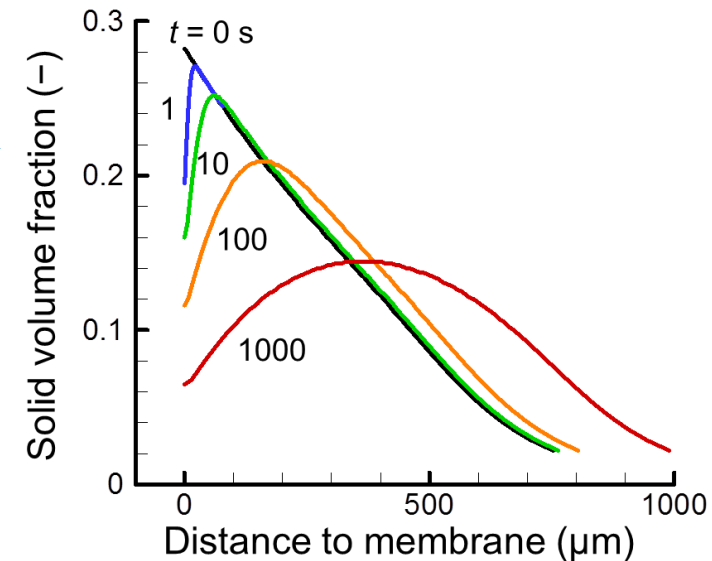
vs

Gels can **swell and then redisperse**,
this is not an immediate process,
it depends on gel thickness

Swelling of colloidal filter cakes/deposits

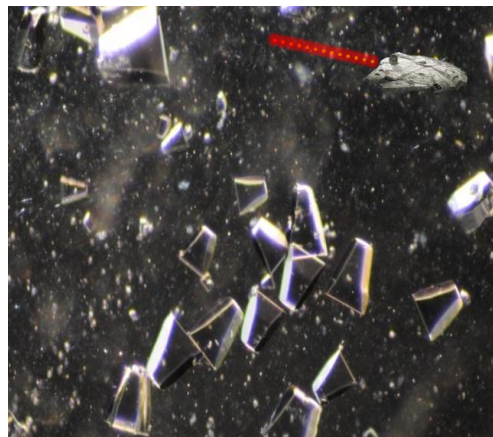
Model of filter cake swelling and removal after membrane filtration

- Water can be absorbed across the membrane
- Membrane resistance is important
- Bell-like concentration distribution
- Cake can be removed before complete swelling





Merci



**Thank you for
your attention**